

Gunter, Jason

From: Nations, Mark <mnations@doerun.com>
Sent: Tuesday, May 13, 2014 2:32 PM
To: Gunter, Jason
Cc: Yingling, Mark; Wohl, Matthew; 'Kevin Lombardozzi' (kevinl@VALHi.NET); Norman Lucas (cityhall@i1.net); robert.hinkson@dnr.mo.gov; brandon.wiles@dnr.mo.gov; Ty Morris (TMorris@barr.com); Cummings, Mark; Hedrick, Samantha K.; Sanders, Amy B.; Bodnar, Gen
Subject: National Progress Report
Attachments: NATL_04-14[1].doc; 03-2014.pdf

Jason, attached is the April report as well as the OLB air summary.

Mark

07CR

40459692

4.2



Superfund



Remediation Group

Mark Nations
Mining Properties Manager
mnations@doerun.com

May 12, 2014

Mr. Jason Gunter
Remedial Project Manager
U.S. Environmental Protection Agency
Region 7 - Superfund Branch
11201 Renner Blvd.
Lenexa, KS 66219

Re: National Mine Tailings Site Progress Report

Dear Mr. Gunter:

As required by Article VI, Section 51 of the Unilateral Administrative Order (Docket No.CERCLA-07-2006-0231) for the referenced project and on behalf of The Doe Run Company and NL Industries, Inc., the progress report for the period April 1, 2014 through April 30, 2014 is enclosed. If you have any questions or comments, please call me at 573-518-0800.

Sincerely,

A handwritten signature in black ink that appears to read "Mark Nations".

Mark Nations
Mining Properties Manager

Enclosure

c: Mark Yingling – TDRC (electronic only)
Matt Wohl – TDRC (electronic only)
Kevin Lombardozzi – NL Industries, Inc.
Matt Whitwell – City of Park Hills
Norm Lucas – Park Hills – Leadington Chamber of Commerce
Robert Hinkson – MDNR
Brandon Wiles – MDNR
Ty Morris – Barr Engineering

National Mine Tailings Site
Park Hills, Missouri
Removal Action - Monthly Progress Report
Period: April 1, 2014 – April 30, 2014

1. Actions Performed and Problems Encountered This Period:

- a. Work continued on the development of the Post Removal Site Control Plan.

2. Analytical Data and Results Received This Period:

- a. During this period, water samples were collected at the sampling locations identified in Appendix C of the Removal Action Work Plan where water was present. Copies of the analytical results from the last sampling event are included with this progress report.
- b. During this period, the Ambient Air Monitoring Reports for Fourth Quarter 2013 and January 2014 were completed. Any issues identified in these reports are discussed below. A copy of these documents has been sent to your attention. These will be the last Ambient Air Monitoring Reports you will be receiving from Barr. All future Ambient Air Monitoring Reports will be coming from Doe Run.

The Fourth Quarter 2013 Ambient Air Monitoring Report noted the following:

- The action levels for lead and dust were not exceeded.
- No sample was taken on the Big River #4 TSP monitor on 10/04/13 due to the run time of the monitor being outside of the acceptable limits. This issue has been addressed.
- There was a QA blank filter for the National #3 (Water Plant) TSP and PM₁₀ monitors on 10/11/13.
- No sample was taken on the Big River #4 TSP monitor on 10/16/13 due to unknown reasons. Follow-up inspections of the monitor indicated that the monitor is working properly.
- No sample was taken on the Big River #4 TSP monitor on 10/29/13 due to an electrical failure. Upon discovery, this issue was addressed.
- No sample was taken on the Big River #4 TSP monitor on 10/30/13 due to a mechanical failure. Upon discovery, this issue was addressed.
- No sample was taken on the National #3 (Water Plant) PM₁₀ monitor on 10/31/13 due to a mechanical failure. Upon discovery, this issue was addressed.
- There was a QA blank filter for the Big River #4 QA TSP monitor on 11/19/13.
- No sample was taken on the National #3 (Water Plant) PM₁₀ monitor on 11/21/13 due to a mechanical failure. Upon discovery, this issue was addressed.
- No sample was taken on the National #1 (Ozark Insulation) TSP monitor on 11/26/13 due to the run time of the monitor being outside of the acceptable limits. This issue has been addressed.
- No samples were taken with the TSP monitors on 11/27/13, 11/28/13, or 11/29/13 due to the holiday.
- No samples were taken with the PM₁₀ monitors on 11/30/13 due to the holiday.
- No sample was taken on the National #1 (Ozark Insulation) TSP monitor on 12/02/13 due to an issue with the timer. Upon discovery, this issue was addressed.
- No sample was taken on the Big River #4 TSP monitor on 12/03/13 and 12/04/13 due to the run time of the monitor being outside of the acceptable limits. This issue has been addressed.
- No sample was taken on the National #3 (water plant) TSP monitor on 12/06/13 and 12/27/13 due to the run time of the monitor being outside of the acceptable limits. This issue has been addressed.

- No samples were taken with the TSP monitors on 12/24/13, 12/25/13, or 12/31/13 due to the holiday.

The January 2014 Ambient Air Monitoring Report noted the following:

- The action levels for lead and dust were not exceeded.
- No samples were taken with the TSP monitors on 01/01/14 due to the holiday.
- No sample was taken on the National #1 (Ozark Insulation) TSP monitor on 01/03/14 and 01/07/14 due to the run time of the monitor being outside of the acceptable limits. This issue has been addressed.
- No sample was taken on the National #1 (Ozark Insulation) PM₁₀ monitor on 01/05/14 and the TSP monitor on 01/06/14 due to a power outage. This issue has been addressed.
- No sample was taken on the National #3 (water plant) TSP monitor on 01/09/14 and 01/10/14 due to the run time of the monitor being outside of the acceptable limits. This issue has been addressed.
- No sample was taken on the Big River #4 QA PM₁₀ monitor on 01/05/14 and 01/11/14 due to the run time of the monitor being outside of the acceptable limits. This issue has been addressed.

3. Developments Anticipated and Work Scheduled for Next Period:

- a. Continue developing the Post Removal Site Control Plan.
- b. Continue developing the Removal Action Report and the record drawings.
- c. Complete monthly water sampling activities as described in the Removal Action Work Plan.
- d. Complete air monitoring activities as described in the Removal Action Work Plan.

4. Changes in Personnel:

- a. None.

5. Issues or Problems Arising This Period:

- a. None.

6. Resolution of Issues or Problems Arising This Period:

- a. None.

Monthly Ambient Air Monitoring Report

The Doe Run Company
Old Lead Belt Sites:
Federal, Rivermines, National, and Leadwood

March 2014



SUITE 300
1801 PARK 270 DRIVE
ST. LOUIS, MO 63146

Federal Site

Sample Results for March 2014

Sample Date	St. Joe (Ballfields)		Big River#4		Water Treatment Plant	
	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3
3/3/14	28	0.025	29	0.013	23	0.013
3/4/14	21	0.033	21	0.013	13	0.006
3/6/14	43	0.053	38	0.020	37	0.033
3/7/14	24	0.020	20	0.013	19	0.020
3/10/14	20	0.034	15	0.007	22	0.021
3/11/14	33	0.049	11	0.007	19	0.021
3/12/14	13	0.013	6	0.013	7	0.013
3/13/14	31	0.047	25	0.007	23	0.007
3/14/14	22	0.014	20	0.013	23	0.021
3/17/14	18	0.027	10	0.007	15	0.013
3/18/14	41	0.055	29	0.020	24	0.020
3/19/14	24	0.027	26	0.026	33	0.121
3/20/14	32	0.054	59	0.013	49	0.040
3/21/14	22	0.118	85	0.007	101	0.014
3/24/14	22	0.020	24	0.006	24	0.020
3/25/14	32	0.033	28	0.013	24	0.033
3/26/14	157	0.320	35	0.020	38	0.026
3/27/14	110	0.283	26	0.013	26	0.034
3/28/14	26	0.014	26	0.007	22	0.007
3/31/14	87	0.117	78	0.041	65	0.129

Monthly Avg. TSP	40	31	30
Monthly Avg. Pb	0.068	0.014	0.031
Feb-14	0.023	0.011	0.019
Jan-14	0.103	0.015	0.046
Rolling 3-Month	0.065	0.013	0.032

Three month rolling average must be less than 0.15 ug/m3

NOTES:

Sample Date	Big River QA	
	TSP ug/m3	Lead ug/m3
3/4/14	22	0.013
3/6/14	37	0.020
3/11/14	11	0.007
3/13/14	21	0.007
3/18/14	32	0.020
3/20/14	52	0.013
3/25/14	27	0.013
3/27/14	30	0.020

Rivermines

Sample Results for March 2014

Sample Date	Big River #4		Rivermines South #1		Rivermines North #2		Rivermines East #3	
	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3
3/3/14	29	0.013	17	0.006	19	0.006	23	0.013
3/4/14	21	0.013	18	0.013	15	0.007	13	0.006
3/6/14	38	0.020	42	0.046	42	0.040	37	0.033
3/7/14	20	0.013	19	0.020	18	0.020	19	0.020
3/10/14	15	0.007	19	0.014	13	0.027	22	0.021
3/11/14	11	0.007	25	0.014	19	0.125	19	0.021
3/12/14	6	0.013	20	0.060	6	0.020	7	0.013
3/13/14	25	0.007	26	0.013	23	0.020	23	0.007
3/14/14	20	0.013	23	0.020	18	0.014	23	0.021
3/17/14	10	0.007	14	0.026	13	0.001	15	0.013
3/18/14	29	0.020	30	0.013	22	0.034	24	0.020
3/19/14	26	0.026	46	0.054	24	0.041	33	0.121
3/20/14	59	0.013	100	0.120	59	0.115	49	0.040
3/21/14	85	0.007	84	0.014	124	0.161	101	0.014
3/24/14	24	0.006	29	0.039	25	0.007	24	0.020
3/25/14	28	0.013	60	0.111	19	0.007	24	0.033
3/26/14	35	0.020	38	0.013	46	0.245	38	0.026
3/27/14	26	0.013	27	0.014	40	0.322	26	0.034
3/28/14	26	0.007	33	0.054	24	0.014	22	0.007
3/31/14	78	0.041	67	0.034	71	0.117	65	0.129

Monthly Avg. TSP	31	37	32	30
Monthly Avg. Pb	0.014	0.035	0.067	0.031
Feb-14	0.011	0.036	0.024	0.019
Jan-14	0.015	0.045	0.028	0.046
Rolling 3-Month	0.013	0.039	0.040	0.032

Three month rolling average must be less than 0.15 ug/m3

NOTES:

Sample Date	Big River QA	
	TSP ug/m3	Lead ug/m3
3/4/14	22	0.013
3/6/14	37	0.020
3/11/14	11	0.007
3/13/14	21	0.007
3/18/14	32	0.020
3/20/14	52	0.013
3/25/14	27	0.013
3/27/14	30	0.020

National Site

Sample Results for March 2014

Sample Date	Big River #4		Ozark #1		Soccer Park #2		Water Treatment Plant	
	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3
3/3/14	29	0.013	29	0.019	24	0.019	23	0.013
3/4/14	21	0.013	29	0.026	34	0.065	13	0.006
3/6/14	38	0.020	53	0.040	71	0.125	37	0.033
3/7/14	20	0.013	36	0.027	58	0.108	19	0.020
3/10/14	15	0.007	28	0.028	45	0.082	22	0.021
3/11/14	11	0.007	15	0.014	34	0.035	19	0.021
3/12/14	6	0.013	14	0.013	18	0.027	7	0.013
3/13/14	25	0.007	33	0.013	52	0.074	23	0.007
3/14/14	20	0.013	31	0.027	48	0.082	23	0.021
3/17/14	10	0.007	18	0.013	41	0.073	15	0.013
3/18/14	29	0.020	33	0.014	46	0.054	24	0.020
3/19/14	26	0.026	24	0.020	28	0.041	33	0.121
3/20/14	59	0.013	37	0.020	54	0.054	49	0.040
3/21/14	85	0.007	83	0.014	81	0.042	101	0.014
3/24/14	24	0.006	20	0.007	38	0.053	24	0.020
3/25/14	28	0.013	30	0.013	29	0.027	24	0.033
3/26/14	35	0.020	70	0.086	91	0.145	38	0.026
3/27/14	26	0.013	42	0.082	86	0.151	26	0.034
3/28/14	26	0.007	19	0.007	22	0.014	22	0.007
3/31/14	78	0.041	57	0.021	80	0.076	65	0.129

Monthly Avg. TSP	31	35	49	30
Monthly Avg. Pb	0.014	0.025	0.067	0.031
Feb-14	0.011	0.011	0.028	0.019
Jan-14	0.015	0.021	0.040	0.046
Rolling 3-Month	0.013	0.019	0.045	0.032

Three month rolling average must be less than 0.15 ug/m3

NOTES:

Sample Date	Big River QA	
	TSP ug/m3	Lead ug/m3
3/4/14	22	0.013
3/6/14	37	0.020
3/11/14	11	0.007
3/13/14	21	0.007
3/18/14	32	0.020
3/20/14	52	0.013
3/25/14	27	0.013
3/27/14	30	0.020

Leadwood

Sample Results for March 2014

Sample Date	Big River #4		Leadwood South #1		Leadwood East #2		Leadwood North #3	
	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3
3/3/14	29	0.013	15	0.006	22	0.006	18	0.006
3/4/14	21	0.013	13	0.019	13	0.006	13	0.007
3/6/14	38	0.020	44	0.077	60	0.026	32	0.007
3/7/14	20	0.013	21	0.033	19	0.007	17	0.007
3/10/14	15	0.007	18	0.007	11	0.007	16	0.007
3/11/14	11	0.007	18	0.007	15	0.007	18	0.007
3/12/14	6	0.013	8	0.013	7	0.007	6	0.000
3/13/14	25	0.007	35	0.013	24	0.007	22	0.007
3/14/14	20	0.013	41	0.020	19	0.007	23	0.007
3/17/14	10	0.007	17	0.026	18	0.007	12	0.007
3/18/14	29	0.020	18	0.000	16	0.007	19	0.000
3/19/14	26	0.026	31	0.020	22	0.007	20	0.007
3/20/14	59	0.013	56	0.020	57	0.007	64	0.007
3/21/14	85	0.007	108	0.014	96	0.007	79	0.007
3/24/14	24	0.006	60	0.025	35	0.032	24	0.013
3/25/14	28	0.013	31	0.026	23	0.007	24	0.007
3/26/14	35	0.020	32	0.006	38	0.007	32	0.007
3/27/14	26	0.013	28	0.000	23	0.007	27	0.000
3/28/14	26	0.007	19	0.027	17	0.006	16	0.000
3/31/14	78	0.041	54	0.007	58	0.007	73	0.007

Monthly Avg. TSP	31	33	30	28
Monthly Avg. Pb	0.014	0.018	0.009	0.006
Feb-14	0.011	0.034	0.010	0.006
Jan-14	0.015	0.025	0.005	0.003
Rolling 3-Month	0.013	0.026	0.008	0.005

Three month rolling average must be less than 0.15 ug/m3

NOTES:

Sample Date	Big River QA	
	TSP ug/m3	Lead ug/m3
3/4/14	22	0.013
3/6/14	37	0.020
3/11/14	11	0.007
3/13/14	21	0.007
3/18/14	32	0.020
3/20/14	52	0.013
3/25/14	27	0.013
3/27/14	30	0.020

Federal Site

Sample Results for March 2014

Sample Date	St. Joe (Ballfields)	Big River #4	Water Treatment
	PM10 (ug/m3)	PM10 (ug/m3)	PM10 (ug/m3)
3/3/14	14	11	4
3/9/14	23	26	25
3/12/14	invalid	1	3
3/15/14	1	3	12
3/18/14	38	11	19
3/21/14	65	42	62
3/24/14	11	2	10
3/27/14	94	19	19
3/30/14	2	13	9

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	31	14	18

NOTES: 3/12/14 St. Joe #4: Less than 23 hours run time

Sample Date	Big River QA
	PM10 (ug/m3)
3/6/14	9
3/12/14	0
3/18/14	65
3/24/14	14
3/30/14	21

Rivermines

Sample Results for March 2014

Sample Date	Big River #4 PM10 (ug/m3)	Rivermines South #1 PM10 (ug/m3)	Rivermines North #2 PM10 (ug/m3)	Rivermines East #3 PM10 (ug/m3)
3/3/14	11	2	10	4
3/9/14	26	25	26	25
3/12/14	1	invalid	1	3
3/15/14	3	2	4	12
3/18/14	11	28	23	19
3/21/14	42	76	60	62
3/24/14	2	21	6	10
3/27/14	19	25	28	19
3/30/14	13	30	9	9

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	14	26	19	18
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NOTES: 3/12/14 South#1: Sampler got turned off during audit, run not complete

Sample Date	Big River QA PM10 (ug/m3)
3/6/14	9
3/12/14	0
3/18/14	65
3/24/14	14
3/30/14	21

National Site

Sample Results for March 2014

Sample Date	Big River #4 PM10 (ug/m ³)	Ozark #1 PM10 (ug/m ³)	Soccer Park #2 PM10 (ug/m ³)	Water Treatment PM10 (ug/m ³)
3/3/14	11	1	6	4
3/9/14	26	23	26	25
3/12/14	1	4	1	3
3/15/14	3	6	11	12
3/18/14	11	8	15	19
3/21/14	42	49	57	62
3/24/14	2	14	14	10
3/27/14	19	36	49	19
3/30/14	13	6	15	9

Compliance with NAAQS is less than 150 ug/m³

Monthly Avg. PM10	14	16	22	18

NOTES:

Sample Date	Big River QA PM10 (ug/m ³)
3/6/14	9
3/12/14	0
3/18/14	65
3/24/14	14
3/30/14	21

Leadwood

Sample Results for March 2014

Sample Date	Big River #4 PM10 (ug/m3)	Leadwood South #1 PM10 (ug/m3)	Leadwood East #2 PM10 (ug/m3)	Leadwood North #3 PM10 (ug/m3)
3/3/14	11	2	4	5
3/9/14	26	22	38	20
3/12/14	1	2	1	1
3/15/14	3	30	19	55
3/18/14	11	18	17	15
3/21/14	42	26	50	34
3/24/14	2	1	9	5
3/27/14	19	7	16	10
3/30/14	13	12	12	13

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	14	13	18	18

NOTES:

Sample Date	Big River QA PM10 (ug/m3)
3/6/14	9
3/12/14	0
3/18/14	65
3/24/14	14
3/30/14	21

Meteorological Data - Old Lead Belt

March 2014

Date_Time	WS MPH	WD	Sigma	Temp_C	BP_mmHg	Rain	Power_Supply
01-Mar-14	3.86	9.65	19.91	4.985	747	0	13.27
02-Mar-14	9.35	356.1	17.14	-8.78	751	0	13.45
03-Mar-14	5.995	7.88	17.42	-10.63	755	0.07	13.5
04-Mar-14	2.248	116.2	17.81	-3.607	750	0.04	13.45
05-Mar-14	1.886	72.2	15.67	-1.105	750	0	13.4
06-Mar-14	1.726	40.44	17.08	0.718	749	0	13.52
07-Mar-14	2.771	193.4	15.77	5.466	745	0	13.43
08-Mar-14	3.995	336.2	14.12	3.178	748	0.01	13.29
09-Mar-14	3.629	—230	19.9	6.954	750	0	13.25
10-Mar-14	6.844	224.3	16.84	14.73	741	0	13.17
11-Mar-14	7.08	213.4	17.32	17.05	735	0	13.14
12-Mar-14	11.72	323.2	15.27	4.378	743	0.14	13.22
13-Mar-14	4.917	195.6	18.94	7.86	746	0	13.22
14-Mar-14	6.562	224.5	16.33	12.4	742	0	13.19
15-Mar-14	3.665	177.9	17.99	10.34	744	0	13.17
16-Mar-14	8.43	19.96	17.34	0.562	744	0.31	13.32
17-Mar-14	2.691	28.73	22.85	0.263	742	0.27	13.32
18-Mar-14	8.16	174.4	19.48	7.52	738	0	13.39
19-Mar-14	5.833	255.8	18.25	7.53	743	0	13.49
20-Mar-14	5.305	222.4	20.8	9.77	746	0	13.47
21-Mar-14	6.67	215.6	18.01	15.49	742	0	13.38
22-Mar-14	7.24	352.6	21.14	6.986	749	0	13.43
23-Mar-14	6.833	354	18.8	1.751	753	0	13.5
24-Mar-14	2.185	41.41	25.82	-0.33	751	0	13.57
25-Mar-14	6.564	310.1	16.93	0.747	750	0.03	13.56
26-Mar-14	6.278	174.1	22.09	2.44	750	0	13.6
27-Mar-14	13.21	189.5	17.91	11.82	739	0.08	13.47
28-Mar-14	4.455	356.1	22.2	8.42	744	0.2	13.4
29-Mar-14	6.308	332.6	15.93	4.962	749	0	13.3
30-Mar-14	3.621	172.5	24.6	8.19	749	0	13.23
31-Mar-14	9.11	186.6	19.9	14.55	743	0	13.16

INQUEST

ENVIRONMENTAL INC.

3609 Mojave Ct., Ste E ◆ COLUMBIA, MO 65202
(573) 474-8110 ◆ FAX: (573) 474-8371

May 5, 2014

Ms. Genevieve Bodnar
Senior Environmental Engineer
The Doe Run Company
SEMO Division

RE: 1st Quarter 2014 Lead/PM10 Samplers Calibration Report.

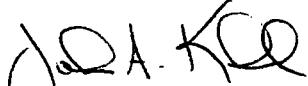
Dear Ms. Bodnar,

Please find enclosed the worksheets detailing the multi-point calibrations that were recently performed on the Park Hills Hi-volume Particulate samplers. A copy of the current certification for the calibration device that was used has also been enclosed.

After the field calibrations were performed, it was discovered that a Flow Rate Look Up Table was not available for the St Joe Park PM10 sampler. The site operator was informed and a different Volumetric Flow Controller (VFC) was installed in the sampler. A new calibration will be performed on the new VFC during the current quarter.

After reviewing the enclosed information, please feel free to call with any comments or questions. Thank you for using our services.

Sincerely,



John A. Kunkel
Inquest Environmental, Inc.

PM10 Sampler Calibrations

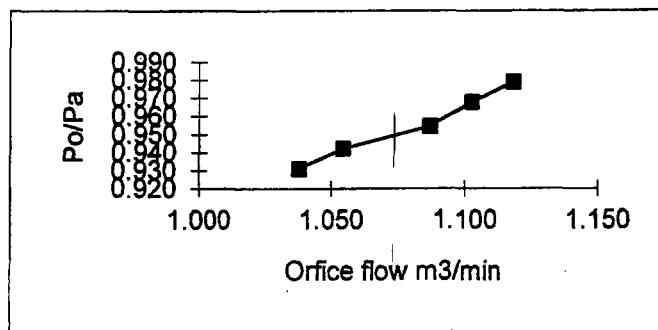
Inquest Environmental, Inc.

**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Big River	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	PM10 Primary	Qa Slope	1.03497
Serial #	P2952	Qa Int.	-0.00227

Temperature (deg F)	36	Elevation (ft)	740
Ta (deg K)	275	SL Press (in Hg)	29.97
Ta (deg C)	2	Pa (mm Hg)	742

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.10	1.038	27.40	51.22	0.931	1.086	4.63
2	3.20	1.055	23.00	42.99	0.942	1.099	4.22
3	3.40	1.087	18.10	33.83	0.954	1.114	2.49
4	3.50	1.103	12.80	23.93	0.968	1.131	2.56
5	3.60	1.118	8.40	15.70	0.979	1.145	2.38
Operational Flow Rate			17.10	31.96	0.957	1.118	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

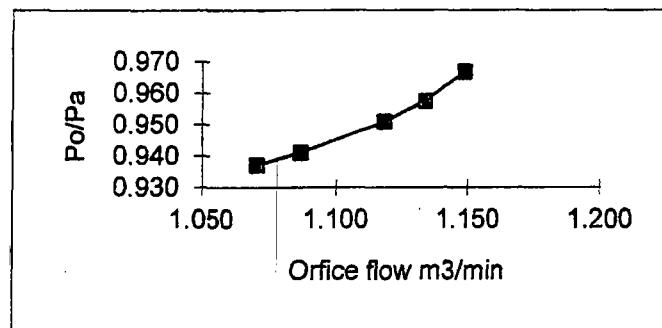
Inquest Environmental, Inc.

**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Big River	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	PM10 QA	Qa Slope	1.03497
Serial #	P1019	Qa Int.	-0.00227

Temperature (deg F)	36	Elevation (ft)	740 .
Ta (deg K)	275	SL Press (in Hg)	29.97
Ta (deg C)	2	Pa (mm Hg)	742

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.30	1.071	25.00	46.73	0.937	1.106	3.28
2	3.40	1.087	23.40	43.74	0.941	1.111	2.21
3	3.60	1.118	19.50	36.45	0.951	1.123	0.41
4	3.70	1.134	16.90	31.59	0.957	1.131	-0.24
5	3.80	1.149	13.20	24.67	0.967	1.143	-0.52
Operational Flow Rate			22.50	42.06	0.943	1.113	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H_2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

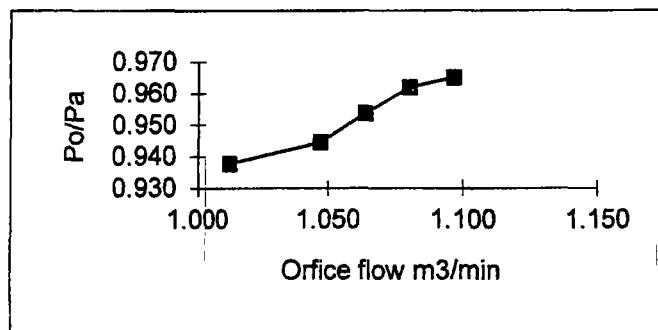
Inquest Environmental, Inc.

**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Haney Park #2	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	PM10	Qa Slope	1.03497
Serial #	P2949	Qa Int.	-0.00227

Temperature (deg F)	46	Elevation (ft)	740
Ta (deg K)	281	SL Press (in Hg)	30.03
Ta (deg C)	8	Pa (mm Hg)	744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	2.90	1.013	24.80	46.36	0.938	1.100	8.59
2	3.10	1.047	22.10	41.31	0.944	1.107	5.70
3	3.20	1.064	18.40	34.39	0.954	1.120	5.26
4	3.30	1.080	15.10	28.22	0.962	1.129	4.49
5	3.40	1.097	13.90	25.98	0.965	1.133	3.31
Operational Flow Rate			22.00	41.12	0.945	1.108	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H_2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

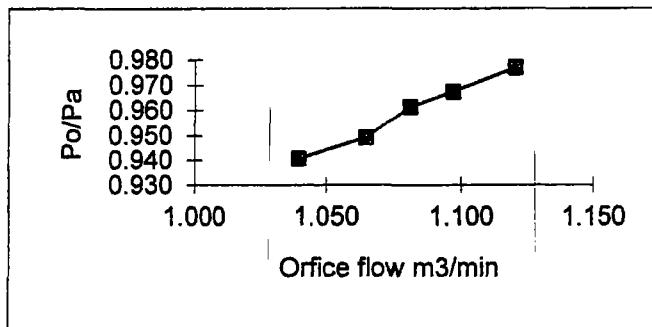
Inquest Environmental, Inc.

**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	<u>Leadwood Mill St</u>	Make	<u>Tisch</u>
Date	<u>03/12/2014</u>	Model	<u>Variable</u>
Tech	<u>J Kunkel</u>	Serial #	<u>1882</u>
Sampler	<u>PM10</u>	Qa Slope	<u>1.03497</u>
Serial #	<u>P1018</u>	Qa Int.	<u>-0.00227</u>

Temperature (deg F)	<u>39</u>	Elevation (ft)	<u>740</u>
Ta (deg K)	<u>277</u>	SL Press (in Hg)	<u>30.04</u>
Ta (deg C)	<u>4</u>	Pa (mm Hg)	<u>744</u>

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.10	1.040	23.60	44.11	0.941	1.114	7.13
2	3.25	1.065	20.20	37.76	0.949	1.124	5.57
3	3.35	1.081	15.40	28.79	0.961	1.139	5.38
4	3.45	1.097	13.00	24.30	0.967	1.147	4.57
5	3.60	1.120	9.20	17.20	0.977	1.159	3.44
Operational Flow Rate			22.10	41.31	0.944	1.118	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler "H2O} * (\text{Ta}/\text{Pa})) - \text{Intercept})$$

$$\text{Po}/\text{Pa} = 1 - \text{Pf}/\text{Pa}$$

$$\% \text{ Diff} = (\text{Look Up} - \text{Qa}) / \text{Qa} * 100$$

Inquest Environmental, Inc.

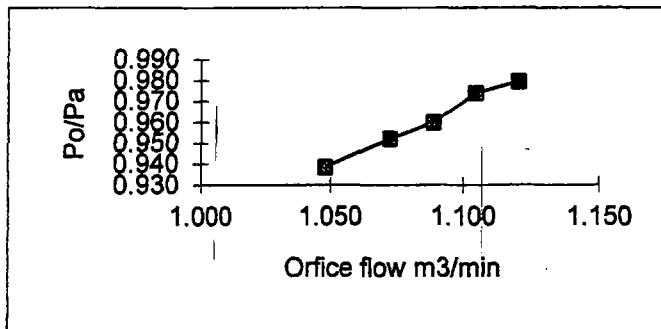
Particulate Sampler Calibration Volumetric Flow Controller

Site	Calibrator		
Location	Leadwood School	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	PM10 Primary	Qa Slope	1.03497
Serial #	P6071	Qa Int.	-0.00227

Temperature (deg F)	<u>39</u>	Elevation (ft)	<u>740</u>
Ta (deg K)	<u>277</u>	SL Press (in Hg)	<u>30.04</u>
Ta (deg C)	<u>4</u>	Pa (mm Hg)	<u>744</u>

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.15	1.048	24.50	45.80	0.938	1.121	6.95
2	3.30	1.073	19.10	35.70	0.952	1.137	5.98
3	3.40	1.089	16.00	29.91	0.960	1.149	5.52
4	3.50	1.105	10.40	19.44	0.974	1.166	5.54
5	3.60	1.120	8.20	15.33	0.979	1.173	4.69

Operational Flow Rate 21.50 40.19 0.946 1.131



Calculations

Qa m3/min= 1/ Slope * (SQRT (Sampler "H2O * (Ta/Pa)) - Intercept)

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - \text{Oa}) / \text{Oa} * 100$$

Inquest Environmental, Inc.

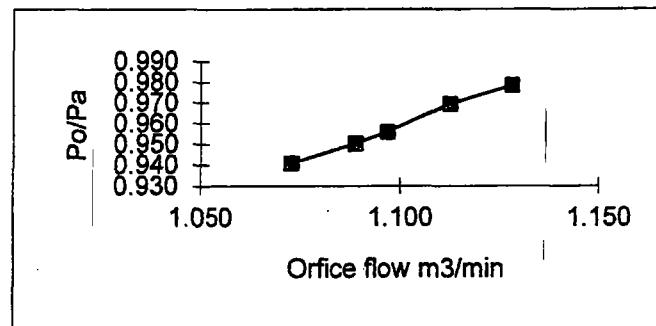
**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Leadwood South	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	PM10	Qa Slope	1.03497
Serial #	P1500	Qa Int.	-0.00227

Temperature (deg F)	39	Elevation (ft)	740
Ta (deg K)	277	SL Press (in Hg)	30.04
Ta (deg C)	4	Pa (mm Hg)	744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.30	1.073	23.50	43.93	0.941	1.125	4.87
2	3.40	1.089	19.80	37.01	0.950	1.136	4.33
3	3.45	1.097	17.60	32.90	0.956	1.144	4.30
4	3.55	1.113	12.20	22.80	0.969	1.164	4.62
5	3.65	1.128	8.60	16.08	0.978	1.171	3.80

Operational Flow Rate	22.10	41.31	0.944	1.129
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Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

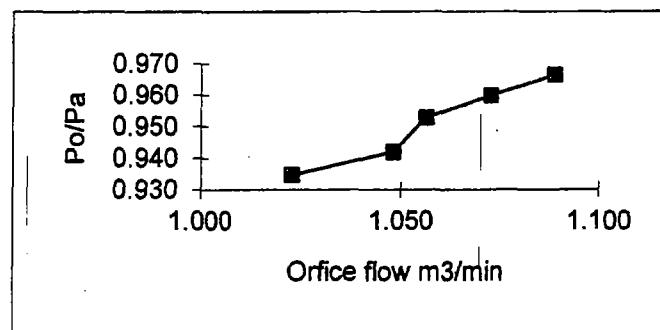
Inquest Environmental, Inc.

**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Ozark #1	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	PM10	Qa Slope	1.03497
Serial #	P2939	Qa Int.	-0.00227

Temperature (deg F)	39	Elevation (ft)	740
Ta (deg K)	277	SL Press (in Hg)	30.04
Ta (deg C)	4	Pa (mm Hg)	744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.00	1.023	26.00	48.60	0.935	1.092	6.75
2	3.15	1.048	23.10	43.18	0.942	1.100	4.94
3	3.20	1.056	18.80	35.14	0.953	1.114	5.45
4	3.30	1.073	16.00	29.91	0.960	1.123	4.68
5	3.40	1.089	13.40	25.05	0.966	1.130	3.77
Operational Flow Rate			22.10	41.31	0.944	1.103	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

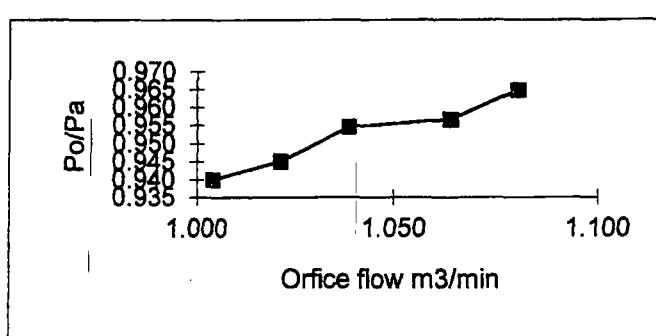
Inquest Environmental, Inc.

**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	River Mines #1	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	PM10	Qa Slope	1.03497
Serial #	P4601	Qa Int.	-0.00227

Temperature (deg F)	46	Elevation (ft)	740
Ta (deg K)	281	SL Press (in Hg)	30.03
Ta (deg C)	8	Pa (mm Hg)	744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	2.85	1.004	23.90	44.67	0.940	1.081	7.64
2	2.95	1.022	21.90	40.94	0.945	1.087	6.39
3	3.05	1.039	18.10	33.83	0.955	1.099	5.79
4	3.20	1.064	17.30	32.34	0.957	1.103	3.66
5	3.30	1.080	14.00	26.17	0.965	1.111	2.82
Operational Flow Rate			21.60	40.37	0.946	1.088	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

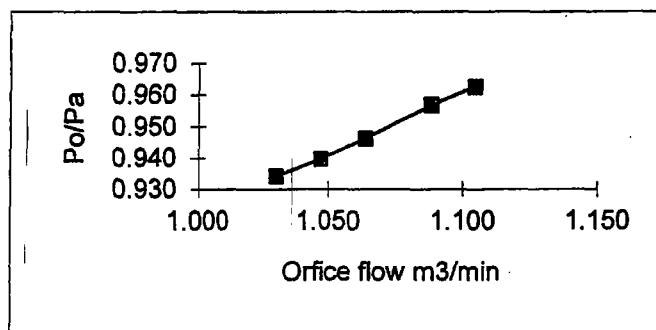
Inquest Environmental, Inc.

**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Wood Street #2	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	PM10	Qa Slope	1.03497
Serial #	P4507	Qa Int.	-0.00227

Temperature (deg F)	46	Elevation (ft)	740
Ta (deg K)	281	SL Press (in Hg)	30.03
Ta (deg C)	8	Pa (mm Hg)	744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.00	1.030	26.20	48.97	0.934	1.093	6.09
2	3.10	1.047	24.00	44.86	0.940	1.101	5.13
3	3.20	1.064	21.40	40.00	0.946	1.108	4.13
4	3.35	1.089	17.20	32.15	0.957	1.122	3.07
5	3.45	1.105	14.90	27.85	0.963	1.129	2.20
Operational Flow Rate			22.40	41.87	0.944	1.106	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

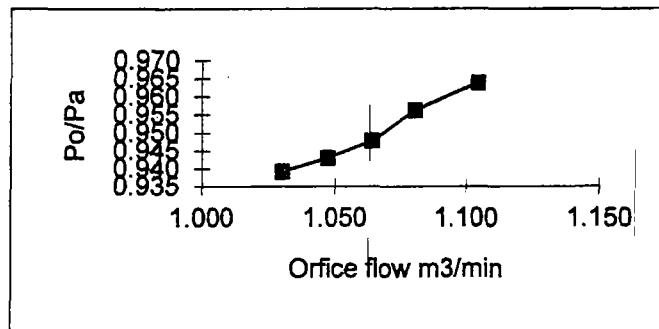
Inquest Environmental, Inc.

**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Water Plant #3	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	PM10	Qa Slope	1.03497
Serial #	P2951	Qa Int.	-0.00227

Temperature (deg F)	46	Elevation (ft)	740
Ta (deg K)	281	SL Press (in Hg)	30.03
Ta (deg C)	8	Pa (mm Hg)	744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.00	1.030	24.20	45.23	0.939	1.107	7.44
2	3.10	1.047	22.70	42.43	0.943	1.112	6.18
3	3.20	1.064	20.80	38.88	0.948	1.118	5.07
4	3.30	1.080	17.40	32.52	0.956	1.128	4.40
5	3.45	1.105	14.40	26.92	0.964	1.138	3.01
Operational Flow Rate			22.00	41.12	0.945	1.115	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H_2O * (\text{Ta}/\text{Pa})) - \text{Intercept})$$

$$\text{Po/Pa} = 1 - \text{Pf}/\text{Pa}$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

TSP Sampler Calibrations

Inquest Environmental, Inc.

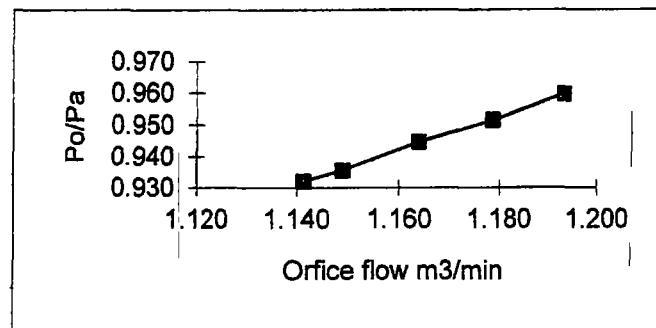
**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Big River	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	TSP Primary	Qa Slope	1.03497
Serial #	P4557	Qa Int.	-0.00227

Temperature (deg F)	36	Elevation (ft)	740
Ta (deg K)	275	SL Press (in Hg)	29.97
Ta (deg C)	2	Pa (mm Hg)	742

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.75	1.141	27.00	50.47	0.932	1.176	3.03
2	3.80	1.149	25.60	47.85	0.936	1.182	2.88
3	3.90	1.164	22.00	41.12	0.945	1.194	2.58
4	4.00	1.179	19.30	36.08	0.951	1.202	1.97
5	4.10	1.193	16.00	29.91	0.960	1.214	1.73

Operational Flow Rate	21.10	39.44	0.947	1.196
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Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

Inquest Environmental, Inc.

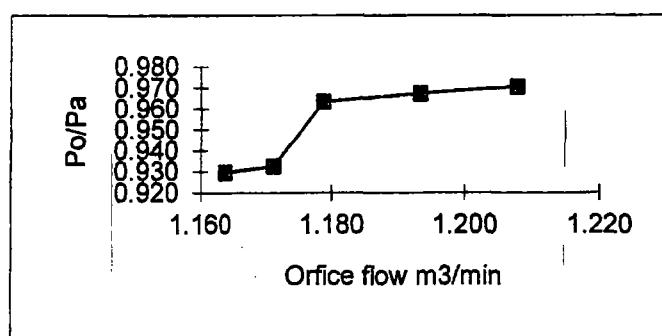
**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Big River	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	TSP QA	Qa Slope	1.03497
Serial #	P4558	Qa Int.	-0.00227

Temperature (deg F) 36
Ta (deg K) 275
Ta (deg C) 2

Elevation (ft) 740
SL Press (in Hg) 29.97
Pa (mm Hg) 742

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.90	1.164	28.00	52.34	0.930	1.169	0.43
2	3.95	1.171	26.80	50.09	0.933	1.173	0.14
3	4.00	1.179	14.50	27.10	0.963	1.213	2.91
4	4.10	1.193	13.00	24.30	0.967	1.218	2.06
5	4.20	1.208	11.70	21.87	0.971	1.223	1.26
Operational Flow Rate			13.00	24.30	0.967	1.218	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

Inquest Environmental, Inc.

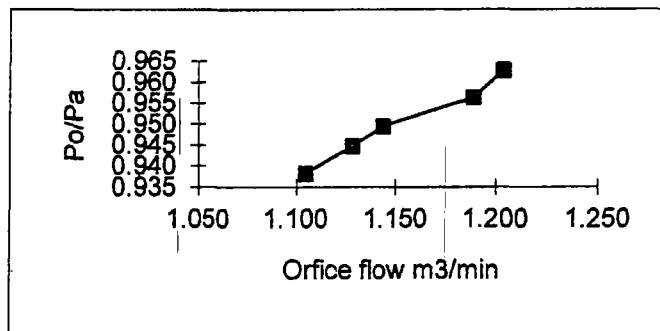
**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Hanley Park #2	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	TSP	Qa Slope	1.03497
Serial #	P4474	Qa Int.	-0.00227

Temperature (deg F) 46
 Ta (deg K) 281
 Ta (deg C) 8

Elevation (ft) 740
 SL Press (in Hg) 30.03
 Pa (mm Hg) 744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.45	1.105	24.60	45.98	0.938	1.178	6.63
2	3.60	1.128	22.00	41.12	0.945	1.188	5.28
3	3.70	1.144	20.10	37.57	0.949	1.173	2.54
4	4.00	1.189	17.40	32.52	0.956	1.202	1.06
5	4.10	1.204	14.80	27.66	0.963	1.211	0.57
Operational Flow Rate			20.90	39.07	0.947	1.19	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H_2O * (\text{Ta}/\text{Pa})) - \text{Intercept})$$

$$\text{Po}/\text{Pa} = 1 - \text{Pf}/\text{Pa}$$

$$\% \text{ Diff} = (\text{Look Up} - \text{Qa}) / \text{Qa} * 100$$

Inquest Environmental, Inc.

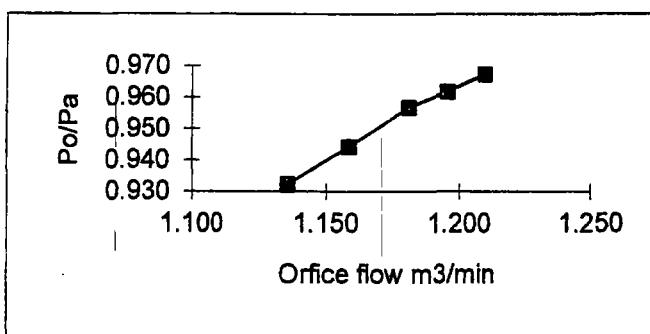
**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	<u>Leadwood Mill Street</u>	Make	<u>Tisch</u>
Date	<u>03/12/2014</u>	Model	<u>Variable</u>
Tech	<u>J Kunkel</u>	Serial #	<u>1882</u>
Sampler	<u>TSP</u>	Qa Slope	<u>1.03497</u>
Serial #	<u>P4476</u>	Qa Int.	<u>-0.00227</u>

Temperature (deg F) 39
 Ta (deg K) 277
 Ta (deg C) 4

Elevation (ft) 740
 SL Press (in Hg) 30.04
 Pa (mm Hg) 744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.70	1.136	27.00	50.47	0.932	1.177	3.62
2	3.85	1.159	22.20	41.50	0.944	1.193	2.97
3	4.00	1.181	17.20	32.15	0.957	1.211	2.55
4	4.10	1.196	15.20	28.41	0.962	1.217	1.80
5	4.20	1.210	13.00	24.30	0.967	1.224	1.16
Operational Flow Rate		20.70	38.69	0.948	1.199		



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

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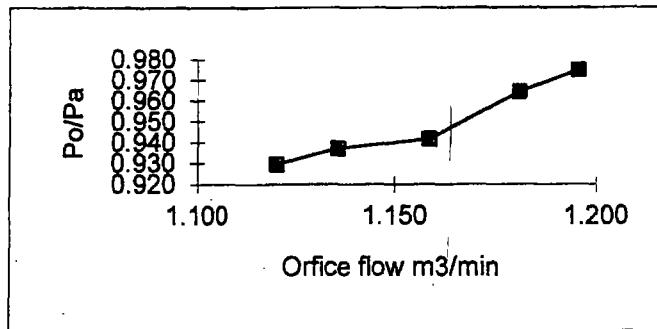
Particulate Sampler Calibration Volumetric Flow Controller

	Site		Calibrator
Location	Leadwood School		Make Tisch
Date	03/12/2014		Model Variable
Tech	J Kunkel		Serial # 1882
Sampler	TSP		Qa Slope 1.03497
Serial #	P6793		Qa Int. -0.00227

Temperature (deg F) 39
 Ta (deg K) 277
 Ta (deg C) 4

Elevation (ft) 740
 SL Press (in Hg) 30.04
 Pa (mm Hg) 744

Test #	Orifice "H2O	Qa m3/min	Sampler "H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.60	1.120	28.00	52.34	0.930	1.165	3.98
2	3.70	1.136	25.00	46.73	0.937	1.174	3.36
3	3.85	1.159	23.20	43.37	0.942	1.181	1.93
4	4.00	1.181	14.20	26.54	0.964	1.210	2.46
5	4.10	1.196	10.00	18.69	0.975	1.224	2.38
Operational Flow Rate			20.50	38.32	0.949	1.19	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler "H2O} * (\text{Ta}/\text{Pa})) - \text{Intercept})$$

$$\text{Po/Pa} = 1 - \text{Pf}/\text{Pa}$$

$$\% \text{ Diff} = (\text{Look Up} - \text{Qa}) / \text{Qa} * 100$$

Inquest Environmental, Inc.

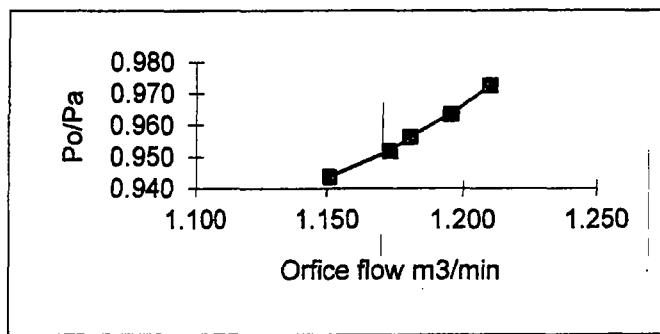
**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Leadwood South	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	TSP	Qa Slope	1.03497
Serial #	P4559	Qa Int.	-0.00227

Temperature (deg F) 39
 Ta (deg K) 277
 Ta (deg C) 4

Elevation (ft) 740
 SL Press (in Hg) 30.04
 Pa (mm Hg) 744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.80	1.151	22.40	41.87	0.944	1.202	4.43
2	3.95	1.174	19.20	35.89	0.952	1.212	3.28
3	4.00	1.181	17.40	32.52	0.956	1.218	3.14
4	4.10	1.196	14.50	27.10	0.964	1.228	2.72
5	4.20	1.210	10.90	20.37	0.973	1.240	2.48
Operational Flow Rate			21.00	39.25	0.947	1.206	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

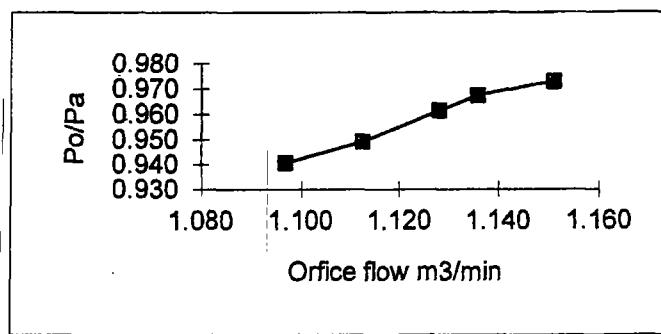
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**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Ozark #1	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	TSP	Qa Slope	1.03497
Serial #	P2939	Qa Int.	-0.00227

Temperature (deg F)	<u>39</u>	Elevation (ft)	<u>740</u>
Ta (deg K)	<u>277</u>	SL Press (in Hg)	<u>30.04</u>
Ta (deg C)	<u>4</u>	Pa (mm Hg)	<u>744</u>

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.45	1.097	23.60	44.11	0.941	1.188	8.31
2	3.55	1.113	20.20	37.76	0.949	1.199	7.76
3	3.65	1.128	15.40	28.79	0.961	1.215	7.70
4	3.70	1.136	13.00	24.30	0.967	1.223	7.67
5	3.80	1.151	10.80	20.19	0.973	1.231	6.95
Operational Flow Rate			13.00	24.30	0.967	1.223	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

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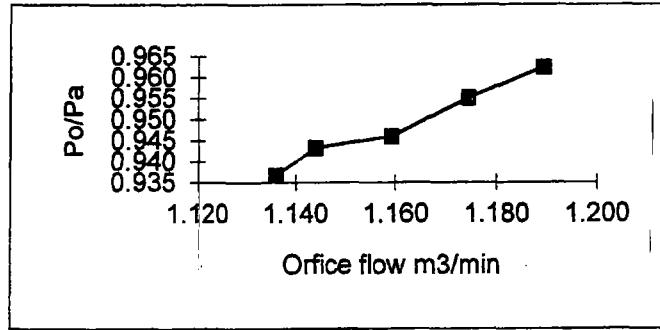
Particulate Sampler Calibration Volumetric Flow Controller

Site		Calibrator	
Location	River Mines #1	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	TSP	Qa Slope	1.03497
Serial #	P2940	Qa Int.	-0.00227

Temperature (deg F) 46
Ta (deg K) 281
Ta (deg C) 8

Elevation (ft) 740
 SL Press (in Hg) 30.03
 Pa (mm Hg) 744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.65	1.136	25.20	47.10	0.937	1.188	4.56
2	3.70	1.144	22.60	42.24	0.943	1.196	4.55
3	3.80	1.159	21.50	40.19	0.946	1.200	3.51
4	3.90	1.174	17.90	33.46	0.955	1.212	3.20
5	4.00	1.189	15.00	28.04	0.962	1.221	2.66
Operational Flow Rate			21.70	40.56	0.945	1.199	



Calculations

Qa m3/min= 1 / Slope * (SQRT (Sampler "H2O * (Ta/Pa)) - Intercept)

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Q_a) / Q_a * 100$$

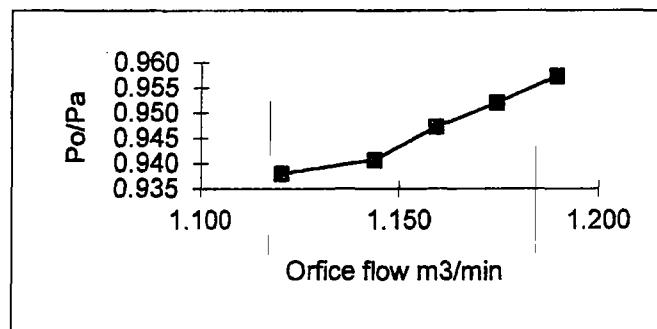
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**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Wood Street #2	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	TSP	Qa Slope	1.03497
Serial #	P2941	Qa Int.	-0.00227

Temperature (deg F)	46	Elevation (ft)	740
Ta (deg K)	281	SL Press (in Hg)	30.03
Ta (deg C)	8	Pa (mm Hg)	744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.55	1.121	24.70	46.17	0.938	1.191	6.28
2	3.70	1.144	23.60	44.11	0.941	1.195	4.46
3	3.80	1.159	21.00	39.25	0.947	1.203	3.77
4	3.90	1.174	19.10	35.70	0.952	1.210	3.03
5	4.00	1.189	17.00	31.78	0.957	1.216	2.24
Operational Flow Rate			21.10	39.44	0.947	1.203	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H_2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

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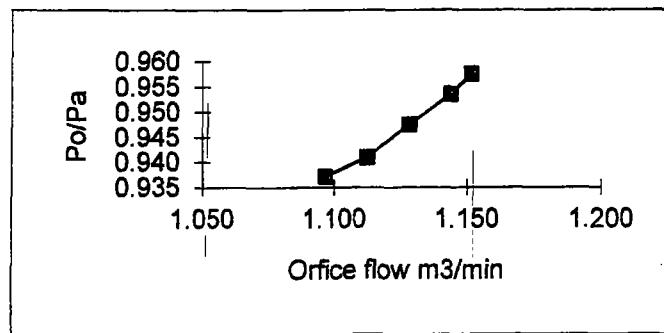
**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	Water Plant #3	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	TSP	Qa Slope	1.03497
Serial #	P4475	Qa Int.	-0.00227

Temperature (deg F) 46
 Ta (deg K) 281
 Ta (deg C) 8

Elevation (ft) 740
 SL Press (in Hg) 30.03
 Pa (mm Hg) 744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.40	1.097	25.00	46.73	0.937	1.184	7.96
2	3.50	1.113	23.50	43.93	0.941	1.188	6.77
3	3.60	1.128	20.90	39.07	0.947	1.196	5.99
4	3.70	1.144	18.50	34.58	0.954	1.206	5.42
5	3.75	1.152	16.90	31.59	0.958	1.211	5.15
Operational Flow Rate			20.60	38.51	0.948	1.198	



Calculations

$$Qa \text{ m3/min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

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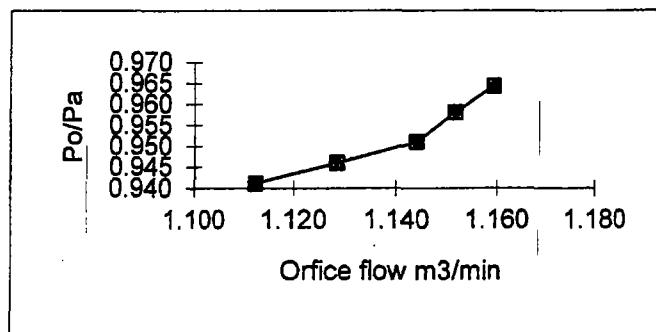
**Particulate Sampler Calibration
Volumetric Flow Controller**

Site		Calibrator	
Location	St Joe Park #4	Make	Tisch
Date	03/12/2014	Model	Variable
Tech	J Kunkel	Serial #	1882
Sampler	TSP	Qa Slope	1.03497
Serial #	P6792	Qa Int.	-0.00227

Temperature (deg F) 46
Ta (deg K) 281
Ta (deg C) 8

Elevation (ft) 740
SL Press (in Hg) 30.03
Pa (mm Hg) 744

Test #	Orifice " H2O	Qa m3/min	Sampler " H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% Diff
1	3.50	1.113	23.40	43.74	0.941	1.192	7.13
2	3.60	1.128	21.50	40.19	0.946	1.198	6.17
3	3.70	1.144	19.50	36.45	0.951	1.205	5.34
4	3.75	1.152	16.70	31.22	0.958	1.214	5.41
5	3.80	1.159	14.20	26.54	0.964	1.222	5.41
Operational Flow Rate			18.70	34.95	0.953	1.208	



Calculations

$$Qa \text{ m}^3/\text{min} = 1 / \text{Slope} * (\text{SQRT}(\text{Sampler } "H_2O * (Ta/Pa)) - \text{Intercept})$$

$$Po/Pa = 1 - Pf / Pa$$

$$\% \text{ Diff} = (\text{Look Up} - Qa) / Qa * 100$$

Calibration Orifice Certification Worksheet



TISCH ENVIRONMENTAL, INC.
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ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Jan 09, 2014 Rootsometer S/N 0438320 Ta (K) - 292
 Operator Tisch Orifice I.D. - 1882 Pa (mm) - 759.46

PLATE OR VDC #	VOLUME START (m ³)	VOLUME STOP (m ³)	DIFF VOLUME (m ³)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H ₂ O (in.)
1	NA	NA	1.00	1.3530	4.1	1.50
2	NA	NA	1.00	1.0430	6.8	2.50
3	NA	NA	1.00	0.9510	8.1	3.00
4	NA	NA	1.00	0.8790	9.5	3.50
5	NA	NA	1.00	0.6660	16.3	6.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
1.0143	0.7496	1.2368		0.9945	0.7350	0.7594
1.0106	0.9690	1.5967		0.9910	0.9501	0.9804
1.0089	1.0608	1.7491		0.9893	1.0402	1.0740
1.0070	1.1456	1.8893		0.9874	1.1233	1.1600
0.9978	1.4983	2.4736		0.9784	1.4691	1.5188

Qstd slope (m) = 1.65282
 intercept (b) = -0.00370
 coefficient (r) = 0.99999

y axis = SQRT[H₂O(Pa/760)(298/Ta)]

Qa slope (m) = 1.03497
 intercept (b) = -0.00227
 coefficient (r) = 0.99999

y axis = SQRT[H₂O(Ta/Pa)]

CALCULATIONS

$$V_{std} = \text{Diff. Vol}[(Pa - \text{Diff. Hg})/760](298/Ta)$$

$$Q_{std} = V_{std}/\text{Time}$$

$$V_a = \text{Diff Vol}[(Pa - \text{Diff Hg})/Pa]$$

$$Q_a = V_a/\text{Time}$$

For subsequent flow rate calculations:

$$Q_{std} = 1/m \{ [SQRT(H_2O(Pa/760)(298/Ta))] - b \}$$

$$Q_a = 1/m \{ [SQRT H_2O(Ta/Pa)] - b \}$$